



Modelling the response of an alluvial aquifer to anthropogenic and recharge stresses in the United States Southern Great Plains

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Abstract:

This paper uses Visual MODFLOW to simulate potential impacts of anthropogenic pumping and recharge variability on an alluvial aquifer in semi-arid northwestern Oklahoma. Groundwater withdrawal from the aquifer is projected to increase by more than 50% (relative to 1990) by the year 2050. In contrast, climate projections indicate declining regional precipitation over the next several decades, creating a potential problem of demand and supply. The following scenarios were simulated: (1) projected groundwater withdrawal, (2) a severe drought, (3) a prolonged wet period, and (4) a human adjustment scenario, which assumes future improvements in water conservation measures. Results indicate that the combined impacts of anthropogenic pumping and droughts would create drawdown of greater than 12 m in the aquifer. Spatially, however, areas of severe drawdown will be localized around large-capacity well clusters. The worst impacts of both pumping and droughts will be on stream-aquifer interaction. For example, the projected aquifer pumpage would lead to a total streamflow loss of 40%, creating losing stream system regionally. Similarly, a severe drought would lead to a total streamflow loss of >80%. A post-audit of the model was also carried out to evaluate model performance. By simulating various stress scenarios on the alluvial aquifer, this study provides important information for evaluating management options for alluvial aquifers.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: visual and USGS MODFLOW; groundwater model;

Exposure :

weather or climate related pathway by which climate change affects health

Extreme Weather Event, Food/Water Security, Precipitation

Extreme Weather Event: Drought

Geographic Feature:

Climate Change and Human Health Literature Portal

resource focuses on specific type of geography

Other Geographical Feature

Other Geographical Feature : semi-arid

Geographic Location: 

resource focuses on specific location

United States

Health Impact: 

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Intervention: 

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation: 

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: 

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: 

format or standard characteristic of resource

Research Article

Timescale: 

time period studied

Medium-Term (10-50 years)

Vulnerability/Impact Assessment: 

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content